Abstract

Malaysia, like any other developing country, considers the construction industry as one of the main contributors to its Gross domestic product (GDP). It is currently facing the housing shortfall crisis. Due to the combination of infamous problems associated with the construction industry, such a fragmentation, lack of productivity and quality, cost and time overrun etc, the Malaysian government proposed industrialised technology 40 years ago as a solution, more commonly referred to as Industrial Building System (IBS). However, the level of implementation of IBS is still below government target. Lack integration among IBS stakeholders during the design stage has been identified as one of the main contributory barrier. Many industry-led reports suggested that the transformation process of the traditional modus operandi toward an integrated approach is pertinent. A number of reports challenged the construction industry to create a fully integrated process capable of delivering predictable results to client through processes and the team integration. As a response to this challenges, and consistent with the needs of the construction industry to be capable of delivering predictable and quality project, therefore, this research hopes to answer this problem and help towards betterment of the IBS Malaysian construction industry using an integrated project team delivery approach. In doing so, a series of interview with multidisciplinary Malaysian IBS experts will be conducted purposely for data collection and validation process guide by the research design and methodology approach of this research. The analysis of data from interviews will be combined with information identified in the literature review in order to develop a framework for effective integrated design team delivery in Malaysian IBS project. Finally, the framework will be validated by further Malaysian IBS industrialists during a Validation Workshop. The final framework can be used as a term of reference for both Malaysian IBS practitioners and academics toward achieving integrated IBS design team practice.

1.0 Introduction

This document is submitted as partial fulfilment of the requirements procedure of the research to be completed. The title of this research is 'Development of Framework for Effective Integrated Design Team Delivery in Malaysian IBS projects.' This document has been organised in the following way. Firstly, it gives a brief background of research problem, aim and objectives, followed by the explanation on research design and methodology (including data finding and analysis process), finding and the development of a framework. Finally, the plan for future work and expected contribution to knowledge and references are given at the end of this report.

2.0 Research Background

The importance of the construction industry to national social-economies is no subject for debate. Its contribution to Gross Domestic Product (GDP), impact on economic activity, government revenue, benefits of investment and employment is highly significant (UKCG Report, 2009; and Xiou, 2002). In Malaysia, the construction industry contributes to around 2.1% of total GDP (Malaysian Construction Outlook, 2008); and it provides job opportunities about 1,214,000 or equating to 10% of Malaysia of the total workforce 12,116,600 (Department of Statistics Malaysia, 2011). Although the construction industry is very competitive, it is currently very labour intensive (Shaari and Ismail, 2003). According to Hamid et al., (2011), around 70%-80% out of total 1,214,000 of registered workers as of June 2011 are foreign workers.

Foreign workers are usually unskilled when they first arrive in Malaysia and this impacted on the productivity and the quality of the construction industry (Hamid et al., 2011; CIDB, 2009; IBS Roadmap, 2003). This problem is worsened by the local

workforce and new Malaysian graduates that are reluctant to join the industry in the past due to the *'3-D syndrome'* (dirty, difficult, and dangerous) which has been long associated with construction industry (Hamid et al, 2008; Ibrahim, 2003).

The Construction Industry Development Board (CIDB) Malaysia, in collaboration with various organisations representing the construction industry, developed the Construction Industry Master Plan (CIMP) that identified and recommended measures to address these problems and challenges (CIDB, 2009). Thus, the Malaysian construction industry has been urged to use innovative construction techniques, and to shift from the traditional practice of brick and mortar systems to an Industrialised Building System (IBS) of construction, or Offsite Manufacturing/ Offsite Construction as it is more commonly known in the other countries. The importance of IBS was highlighted under the Strategic Thrust 5: Innovate through R&D to adopt a new construction method in the Construction Industry Master Plan 2006-2015 (CIMP 2006-2015) which has been published as means to chart the future direction of the Malaysian construction industry (CIMP, 2005). This initiative has been recommended based on some analysis of IBS from others countries, such as UK government commissioned reports which have proposed IBS as an important contributor to progress in the construction industry (Egan, 1998; Barker, 2004; and Blismass and Wakefield, 2008).

Numerous studies (Pan, 2006; Buildoffsite, 2008; Gibb, 1999; Housing Forum, 2000; Parry et al., 2003; Sparksman et al., 1999; IEM, 2001; Senturer, 2001; Venables et al., 2004) show that IBS offers a lot of benefits to adopters in terms of cost and time certainty, attaining better construction quality and productivity, reducing risks related

to occupational safety and health, alleviating the lack of skilled workers and dependency on manual foreign labour, and achieving the ultimate goal of reducing overall cost of construction whole life performance and profits. Based on these benefits, the government of Malaysia recognised an IBS as one of the strategies in the National Construction Industry Master Plan which aimed to speed up the delivery time, and to build affordable and quality houses.

3.0 Problem Statement and Justification

Despite the well-documented benefits and strong support from the Malaysian government, the take-up for IBS was not as high as anticipated (Hamid et al., 2008; IBS Review, 2007; Waleed et al., 2003). Low labour costs in Malaysia could perhaps be the root cause of the problem (Kamar et al., 2009; Hamid et al., 2008; IBS Review, 2007). Although members of the industry are open to the idea, a major proportion of industry stakeholders in the private sector are indifferent, perhaps due to resistance towards change, and insufficient funds and information to support the feasibility of change (Kamar et al., 2009; Hamid et al., 2008).

In an attempt to understand the poor diffusion of IBS, some researchers (Kamar et al., 2009; Hamid et al., 2008; IBS Review, 2007; and Nawi et al., 2007a) have investigated the barriers to effective IBS implementation in construction. One of the main barriers of IBS implementation in the Malaysian construction industry is related to poor integration among stakeholders during the design stage (Kamar et al., 2009; Haron et al., 2009; Hashim et al., 2008; Chung, 2006; Haron et al., 2005; and Thanoon et al., 2003); and it is reported as more critical to address than the aforementioned barriers to IBS implementation. This central issue specifically can

affect the various stakeholders in the IBS value chain: either, manufactures, designers, local authorities, contractors, suppliers or clients.

According to CIDB (2009), a radical improvement in the procurement system and supply chain process towards a more integrated approach is needed in order to achieve IBS success in the Malaysian construction industry. As construction becomes more innovative, competitive and complex, more participants are involved in IBS projects and thus, more integrated collaboration is needed especially during the design phase of the construction life cycle process. The current IBS Malaysian project process is based on the traditional construction project process (Nawi and Lee, 2010; CIDB, 2009; Fikri, 2005). This traditional construction process however is unsuited to IBS construction and poses a substantial barrier to its adoption (Blismass and Wakefield, 2008).

The traditional construction process has been widely criticised for its fragmented approach to project delivery and its failure to form effective teams. Latham (1994) highlighted that the traditional construction process involves players that are disconnected from each other and work in isolation resulting in inefficiencies. Non-collaboration and co-ordination between the parties involved in construction also can lead to conflict and has a negative impact on the quality of the design process and design outcome (Dulaimi, 2002; Sonnenwald, 1996; and Flanagan & Norman, 1993). As a result of this fragmentation, the traditional construction process tends to incur additional costs from rework stemming from errors, quality issues and inefficiency of project delivery times (Akintoye et al., 2000; Egan, 1998; and Evbuomwan & Anumba, 1998), poor performance (Love and Gunasekaran, 1998) and client dissatisfaction of products delivery (Egan, 2002; Mohamed, 1999).

Many industry-led reports (Bourn, 2001; Egan, 1998; Egan, 2002; Latham, 1994; Strategic Forum for Construction, 2003) have all called on the industry to change from its traditional modus operandi and perform better through increased integration. Recent follow-up reports such as the UKCG (2009) and Egan (2002), challenged the construction industry to create a fully integrated service capable of delivering predictable results to clients through processes and team integration.

Based on the above discussion, the need for greater collaboration in design project team delivery in IBS projects is paramount. According to Titus and Brochner (2005), to achieve integration, improvement in communication and relationships are needed. This includes maintaining long-term relationships with supply chain members (Buzell and Ortmeyer, 1995), working cooperatively without boundaries among the various project members (Baiden et al., 2006), free information sharing with the supply chain (Lee and Whang, 2000), strong commitment at all levels of the multidisciplinary project team (Evbuomwan and Anumba, 1998); and to operate in an atmosphere where relationships are equitable, members are respected each other and has a 'no blame' culture (Dainty et al., 2001).

In this context, information and knowledge sharing is a fundamental approach that underlies both communication and collaboration. According to Baiden et al., (2006), this information sharing approach can be achieved through an integrated working environment between the different participants. However, the tangible examples of full integration achievement in the industry are limited (Vincent and Kirkpatrick, 1995; Vyse, 2001). Previous researches (such as Egan, 1997; Latham, 1994; and Akintoye, 2000) suggest that this level of integration is still lacking in the

construction process, particularly during the design process. Even though there are many related studies (i.e. Song et al, 2006; Baiden et al., 2006; Buzell and Ortmeyer, 1995) concentrated in this area and attempts to improve construction design team integration, however they do not specifically provide any guideline on how to achieve a successful integrated design team delivery. The findings from the literature review which explored team integration frameworks, tools or strategies (i.e. Supply Chain Management, Partnering, Concurrent Engineering, Lean thinking etc.) identified that there were varying advantages and disadvantages between them, and this has obviously caused some confusion for industry practitioners especially for Malaysian IBS stakeholders as which approach to choose towards improved integrated team practice.

Accordingly, research into integrated team practice is necessary in order to enhance the level of integration and communication among stakeholders during the design stage if the full potential of IBS for both the industry and its clients is to be realised.

As a response to that challenge, and consistent with needs of the construction industry, therefore, this research focuses on identifying the critical success factors of an integrated team that will improve the effectiveness of teamwork in the design stage of IBS projects. In addition, the proposed framework will help IBS practitioners (including manufacturers, suppliers and contractors) to get involved and share their knowledge early during the design stage of IBS construction projects.

4.0 Research Aim and Objectives

4.1 Research Aim

This research aims to develop a framework for effective integrated design team delivery in Malaysian IBS projects.

4.2 Objectives

The specific objectives of the research are to:

a) investigate the existing practice of IBS implementation, particularly in the design process and its barriers to implementation in the Malaysian construction industry;
b) gain a theoretical knowledge and review existing practices of integrated design teams;
c) identify the key factors associated with integrated design team delivery success;
d) develop a framework for effective integrated design team delivery in Malaysian IBS projects;

5.0 Research Process and Methodology

This section presents a brief description of the research philosophy, approach, design and method for data collection. According to Philiphs and Pugh (2005), research is processes of finding out something you don't know and as a systematic and methodical process that increases knowledge (Amaratunga et al., 2002). On the other hand, research methodology is a systematic and orderly approach taken towards the collection and analysis of data (Collis and Hussy, 2003).

Selecting an appropriate research methodology is very important for defining a research problem and addressing the questions to be explored (Yin, 2003). It

embraces the overall approach of the research. Therefore, it requires the logic of a research strategy/ philosophy which is embedded in the links between ontology (what counts for reality), epistemology (what is the relationship between the enquirer and the unknown) and methodology (how do we know the world, or gain knowledge of it) (Denzin and Lincoln, 2000; Gray, 2004).

As this research attempts to develop a framework for improving team integration by considering the stakeholders perspectives (detail explanation will be highlighted in Section 7.0), therefore, the nature of this research will be more geared towards a qualitative study (verbal survey), which is governed by the qualitative inquiry of 'what' and 'how' questions.

There are five stages including literature review, exploratory, data collection, framework development, validation and recommendation to be followed by this qualitative research process (refer Figure 1). This methodological framework is very important in order to alleviate that the stages or layers within the research process give a sense of a 'sequence' and as a guideline for the researcher to monitor that the research undertaken is more or less on the right track (Kagioglou et al., 1998; Saunders et al., 2007; Keraminiyage, 2009).

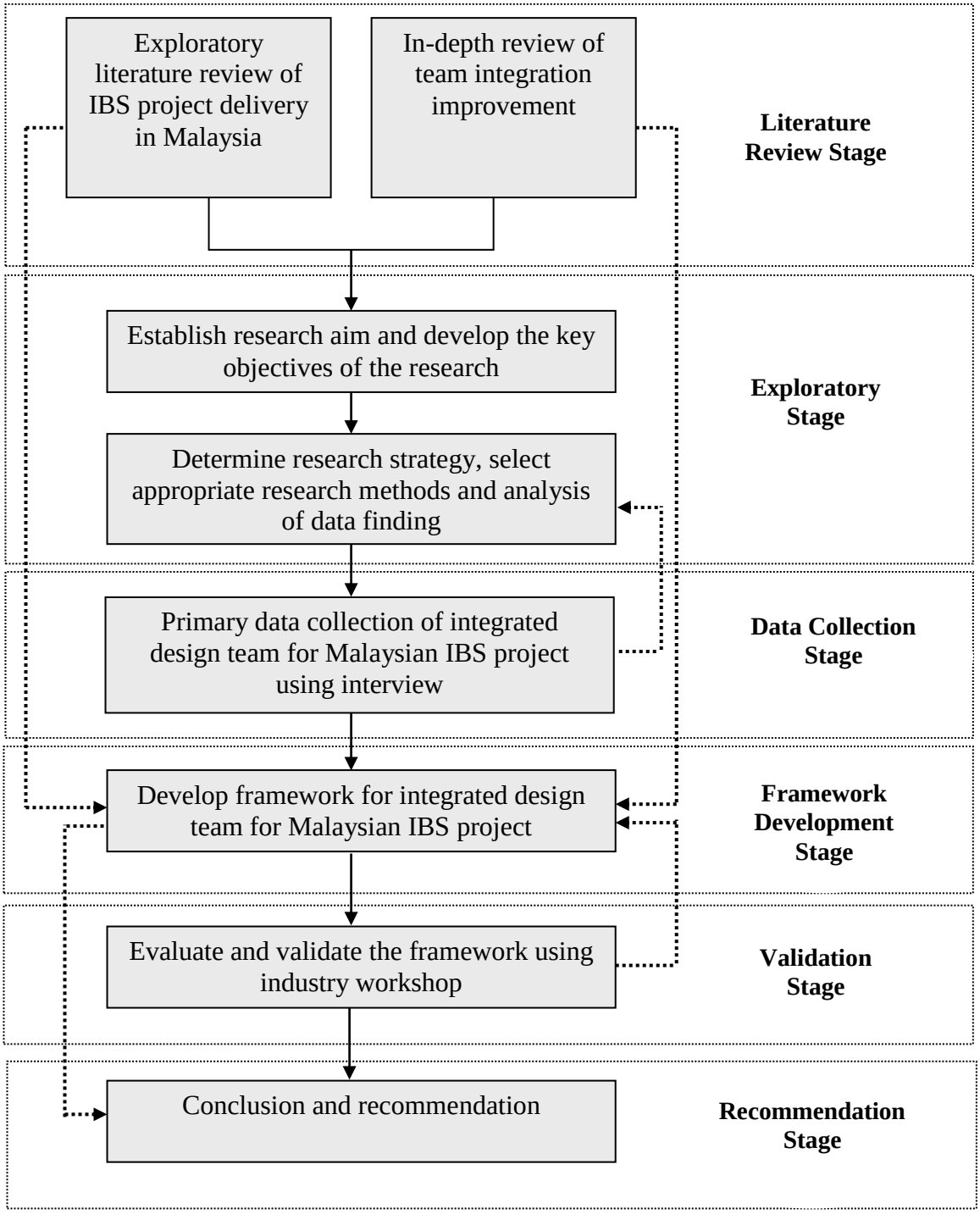

Figure 1: Flow diagram of methodological framework

According to Yin (2009), selecting an appropriate research methodology should be clearly based on a particular research philosophy and, when reported, should describe the process of the research, the particular style and different methods used, the extent of control the researcher has over actual behavioural events, the degree of focus on

contemporary events, and the nature of the enquiry. Towards achieving the aim of this research in being systematic, it will follow the methodology of 'onion' research model introduced by Saunders et al (2009). Figure 2 below summarised the research design and methodology implemented in this research.

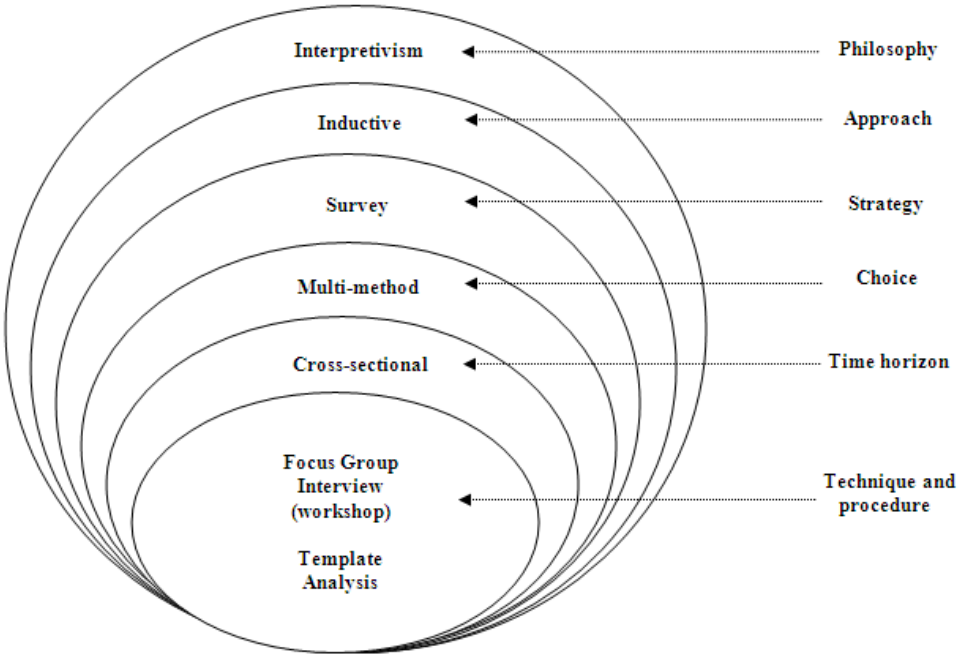

Figure 2: Summary of research design and methodology (Saunders et al., 2009)

5.1 Research Philosophies

Research philosophy is dependent on the researcher's thinking and assumptions about the progress of knowledge which, in turn, affects the way the research is done (Saunders et al., 2007). It contains important assumptions that will underpin the research strategy and methods chosen as part of that strategy.

In the context of this research, it involves a study that is focused on identifying the critical success factors that are necessary for effective integrated design team delivery of Malaysian IBS construction projects. Accordingly, this research involves such studies on social perspective and integration between different players from

different social groups or perspectives (based on experience and knowledge) in order to gather an in depth understanding of complex behaviors and processes of project design delivery, including issues such as culture, environment, organization structure, and attitude of team members on working practices within the project delivery team. Current frameworks of integrated practice such as partnering, SCM, lean principle, concurrent engineering etc. will be reviewed. Based in this context, this research adopts a social science research stance.

In social science research, there are two main research philosophies, namely positivism and interpretivism (Easterby-Smith et al., 2002). Easterby-Smith et al., (2008) described positivism as *"the social world exists externally, and that its properties should be measured through objective methods rather than being inferred subjectively through sensation, reflection or intuition"*. Furthermore, Mohd Tobi (2010) defined positivism as *"a behaviorism and cognitivism based learning and instructional theories are grounded in positivist philosophy because they suggest that learning can be acquired and that reality as well as knowledge is discovered, rather than created"*. The philosophy is usually attached to the ontological assumption of reality being external and objective (Easterby-Smith et al, 2002; Keraminitage, 2009; Tobi, 2010).

On the other hand, Easterby-Smith et al., (2008) described interpretivism (constructionism) as something which *"focuses on the way that people make sense of the world, especially through sharing their experiences with others via the medium of language"*. In addition, Tobi (2010) defined interpretivism as *"a social learning based theories are more closely aligned with constructivist philosophy because they*

suggest that knowledge is constructed based on experience with the world and people, so that reality is constructed".

Based on the discussion in above, research can be placed at two extreme ends of a continuum either ending with positivism or interpretivism. This placing process is based on three main fundamental assumptions of the research philosophy;

- Ontological assumptions which deals with the nature of reality. (e.g. What does research focus on? / What's out there to know?)
- Epistemological assumptions which deals with the nature of knowledge. (e.g. What kind of knowledge is research looking for? /What and how can we know about it?)
- Axiological assumptions which deal with nature of the value the researcher places on the study (e.g. What researcher values go into it?)

Often, within a research project, ontological assumptions, epistemological assumptions and axiological assumptions are interconnected (refer Figure 3) and can be described as characteristics of the research philosophy (Keraminitage, 2009).

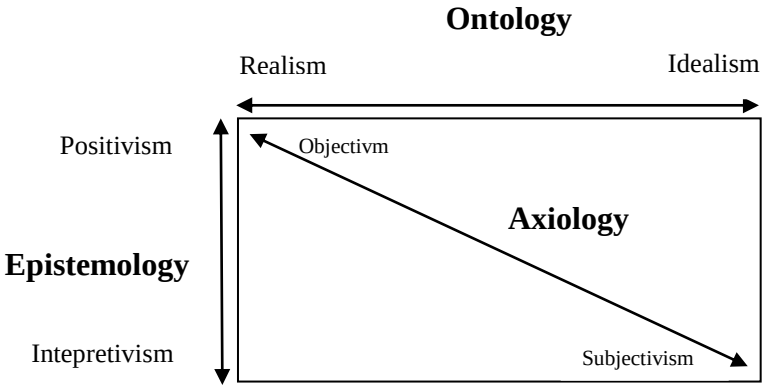

Figure 3: Philosophical Orientation

Regarding the characteristics of both research philosophies (positivism and interpretivism), research positioning towards interpretivism has been identified as the most appropriate research philosophy for this study. Literatures (Love et al., 2004; Mohammed, 1999; Evbuomwan and Anumba, 1998; and Russell, 1994) demonstrated that even with existing integrated frameworks (i.e. concurrent engineering, SCM, Partnering, IPD etc.) the Malaysian construction industry, unfortunately, has struggled to comprehend practical and tangible examples or guidelines of how practitioners can achieve a successful integrated design team delivery in IBS projects. Therefore, this study seeks to provide a practical framework for Malaysian IBS practitioners with intention to improve design team integration. In this regard, this study requires the researcher to understand, explore, and elicit opinions and perceptions from Malaysian construction practitioners; hence this research sits within the interpretivism paradigm. In contrast, the positivism paradigm is more towards establishing a strictly cause-effect relationship instead of understanding the issue thus inappropriate to be applied with this study.

The positioning of the research paradigm for this study is summarized as having these three qualities as follows:

- *Ontological assumption*

In developing a new framework, this study is directed from the respondent's view, based on their reality of actual experience and practice (realism) instead of an unpractised opinion view (idealism) relating to the Malaysian IBS construction industry. Furthermore, this research aims to generate rich data in order to build up theories. Therefore, this study is theory building rather than theory testing. Additionally, the research environment is not expected to be controlled and

simplified with assumptions and hypotheses as in the deductive research approach used in positivist studies.

- *Epistemological undertaking*

As discussed earlier, the nature of this study leans more towards interpretivism. Therefore, it is rooted in the notion of lived-world experience that involves a socially constructed instead of ideality among multiple stakeholders in order to seek the information for developing a new integrated team framework. Thus, the research environment cannot be controlled as the idea constructed is determined by human beliefs and interests whereas the knowledge is gained from the participation. Accordingly, constructivism assumption has been identified as the most appropriate research epistemological for this study based on knowledge gathered by examining the variety of project delivery models, frameworks, approach and tools in traditional and IBS construction method.

- *Axiological purpose*

This research also tends to validate the developed framework of CSFs of an effective integrated design team delivery in the Malaysian IBS projects. The phenomenon under this study is interpreted within a context through direct interactions and involvement among IBS project multiples stakeholders and experts (i.e. clients, designers, project manufacturers, and contractors) as discussed earlier. In this context, this study leans more towards the value-laden research choice.

In conclusion in terms of this study's research philosophy, this research leans more towards interpretivism with the ontological stance of realism, followed by

epistemological territory of social constructionism and the axiological view of being value laden. This philosophical stance of the research influences the selection of an appropriate research approach as described within the next section. The following section focuses on the second layer (second section; see Figure 4.2) of the onion model, establishing the appropriate research approach for this research.

5.2 Research Approach

Very simply, deductive research refers to the theory testing process which starts with an established theory, then formulates a hypothesis and seeks to observe whether the theory applies to specific instances (Hyde, 2000). In other words, it is a strategy in which theory informs research at the outset and hypotheses dictate what evidence the researcher looks for (Grix, 2010). Data is collected to confirm or falsify the hypotheses.

The inductive theory on the other hand, is an inquiry to understand a social or human problem from multiple perspectives (Yin, 1994). Researchers in inductive research intend to gain richer and deeper information and they try to keep their minds open for any possible results whilst proposing a set of further steps for data collection in an attempt to answer the phenomena in question (Sutrisna, 2009).

It can be concluded that deductive reasoning is a theory testing and goes from the general to the specific, whilst inductive reasoning is theory building and goes from the specific to the general. Inductive research is often associated with interpretivist philosophy while deductive research is often associated with positivist philosophy (Sutrisna, 2009; Saunders et al., 2003).

However, in order to gather all the information, a researcher needs to clarify the process of the data collection in appropriate manner. Previous researchers (Grix, 2010; Yin, 2009; Saunders et al., 2009; Creswell, 2009; and Sarantakos, 2005) advocated that the terms of quantitative and qualitative data have been used widely in social and management research in order to distinguish both data collection techniques (such as questionnaire or interview) and data analysis procedures (such as categorizing data). The term quantitative data for example is used to describe a type of information that can be counted or expressed numerically (Creswell, 2009). Quantitative research is usually being used in order to gather and explain on quantification or mathematical of data.

Otherwise, qualitative data relies on text and image which are concerned with describing meaning, rather than with drawing statistical inferences (Creswell, 2009). Therefore a qualitative research approach is more appropriate in the collection and analysis of the type of data (Sarantakos, 2005). Typically, this research follows an inductive approach in relation to theory. Further, qualitative research often relies on interpretive or critical social science and follows a non linear research path. Fundamentally, qualitative researchers tend to collect three kinds of data; in-depth and open-ended interviews; direct observations and written documents (Baiden, 2006). These yield quotations, descriptions and excerpts which are either unstructured or semi-structured (Patton, 2002). Compared to quantitative research, just a small number of, usually, non-representative cases are used and respondents are selected to fill a given requirement in the qualitative research (Sherif, 2002).

According to the research philosophy, the nature of this study is not theory testing but rather theory building; and the researcher intends to gather deep and rich information of verbal and describing of data. Therefore, the inductive approach that based on qualitative research will be chosen as the reasoning for this study. The next section will discuss the process in more detail under research strategies.

5.3 Research Strategy

According to Saunders et al., (2009), research strategy is important because it will enable the researcher to answer the research questions and meet the objectives. The implementation of research strategy is guided by research questions and objectives, the existing knowledge, the amount of time and other resources available, as well as the research philosophical underpinnings. Yin (2009) also pointed out three conditions which can be used to select the appropriate strategy for the research:

• the type of research question;

• the control of the researcher over behavioral events;

• the degree of focus on contemporary as opposed to historical events

Based on the literature reviews (Yin, 2009; Saunders et al., 2009; Sexton, 2003), eight main strategies (experiment, survey, case study, archival research, action research, grounded theory, ethnography, and history) have been categorised as a guideline to be followed in a research. The summary of the relevant situation of different research strategies is shown in the Table 1 below.

Table 1: Relevant Situation for Different Research Strategies

Research Strategies	Advantages	Disadvantages	Form of research question	Requires control of behavioral events?	Focuses on contemporary events?
Experiment	Clear possibility & answer; controlled context, replicable generable; safe time and resources; causal relationship	Requires specific knowledge; artificial; ethical problem due to variable control; quantitative does not really explain	How, why	Yes	Yes
Survey	Widely used; quantitative and qualitative; directive; affordability of large data; high predictability using	Misplace findings; difficult to obtain truthful data; less detail and depth; may be not applicable for phenomenon studies	Who, what, where, how, how many, how much	No	Yes
Case study	In-depth, capture complexities, relationship; multiple data sources and methods; flexible time and space; less artificial	Problem of generalization; focus on natural situation; unpredictable; unacceptable for some course	How, why	No	Yes
Action research	Collaborative; the researchers and context integrity; for practitioner-researchers; professional and personal development; practical	Difficult for new researcher; exclusive; work setting influence; unacceptable for some course	How	Yes	Yes
Grounded theory	Generating theory from a research; flexible structure; detailed set of rules and procedures	Too specific; ignore the previous knowledge to the analysis; many variants of the strategy	'How', focus on process	No	Yes
Ethnography	Feasible within the constrain of time and researches; direct observation; no specific data collection methods; rich data; deal with culture, inclusive	Difficult for new researcher; high skill needed; descriptive to explanative; ethical issues; limited accessibility; problem of generalization	'Why', to understand context and perception	No	No

Archival research (documentary study)	Independent researcher; the researcher will not influence the quality of the documents; can be reviewed repeatedly	The documents might be produced for specific reason; lead to bias; can be difficult to find (irretrievability)	Who, what, where, how many, how much	No	Yes/no
History	Applicable deal with 'dead' sources of evidence; can be reviewed repeatedly	The data is limited in term of in-depth descriptions (not produced specific reason)	How, why	No	No

Sources: Sarantakos (2005), Robson (2007), Yin (2009), Saunders et al., (2009); Grix (2010) and Setiawan (2010)

Since this study will gather qualitative data in order to address the questions of 'what' (to explore the context of a number of variables associated with effective integrated design team delivery in IBS projects) and 'how' (to investigate, which requires in-depth information and explanation of the data to be collected – problems and CSFs), this research requires a thorough review of literature as secondary data with combination of a workshop (verbal survey) for the primary data (explanative data) to form the framework of CSFs.

In this regard, the survey strategy (verbal based) is considered as the appropriate strategies for this study rather than case study and archival research (refer Figure 4).

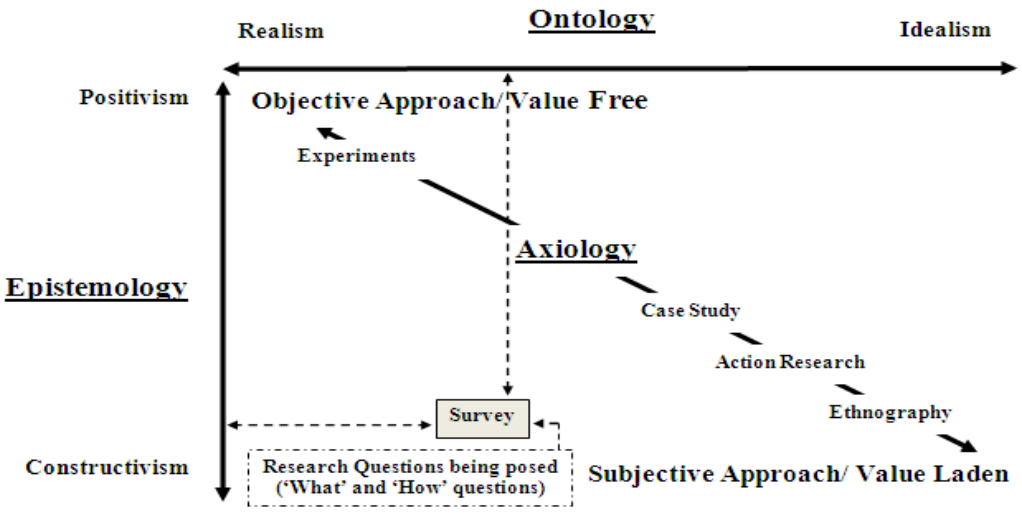

Figure 4: Position research paradigm (adapted from Sexton, 2003; and Yin, 2003)

5.4 Research Choices

Saunder et al., (2009) claimed that identifying an appropriate 'research choice' is very important for the guidance of research techniques and procedures selection process. There are three types of research choice in social management research; mono method, multi-method and mixed methods. All the methods can be used by the researcher either as a single data collection technique and corresponding analysis procedures (mono method), use more than one data collection technique and analysis procedures (multiple methods) or use both quantitative and qualitative data collection techniques and analysis procedures to answer the research question or meet the research objective (mixed methods approach) (Saunders et al., 2009).

As explained earlier, this research will apply a survey as the main strategy for qualitative primary data collection process and the literature review as a main source for the secondary type of data. This study therefore will involve soft, descriptive and less structured data (qualitative data) whereas the researcher intends to gather deep and rich information from the views and reaction of multiple Malaysian IBS stakeholders (knowledge based experience). Accordingly, all secondary sources of data that is related to historical data or with the focus on non-contemporary events (i.e. archival records) are irrelevant to be applied in this study. The strategy of this research however does not focus on investigation or exploration of interpersonal behaviours and motives thus disqualified any sources related to observations to be applied in this study. Furthermore, the nature and duration of study does not allow involvement on confidentiality issues and, therefore, physical artefacts are not used as data sources as well.

According, this research approach will follow qualitative multi data collection techniques (refer to section research technique) corresponding analysis procedure (multi-method qualitative studies) for the research time horizons that will be discussed in the next section.

5.5 Time Horizons (cross-sectional studies)

In the discussion of time horizons, there are two main terms known as ‘snapshots’ time horizon and ‘dairy’ perspective. According to Saunders et al., (2009), ‘snapshots’ time horizon is referred to as cross-sectional while and ‘dairy’ perspective is called longitudinal. Typically, this time horizons depend on the research question.

Cross-sectional studies

Previous researchers (Easterby-Smith et al., 2008; Robson, 2002) highlighted that cross-sectional studies are often employed to the survey strategy. This research seeks to describe the incidence of a phenomenon or to explain how factors are related in different organisations. For example, there are many survey studies conducted based on interviews over a short period of time such as focus group interview (workshop). Therefore it could be used either as quantitative or qualitative methods.

Longitudinal studies

On the other hand, longitudinal research is based on the long term period of study. According to Saunders et al., (2009), the main strength of this research is the capacity it has to study change and development. The best example of this research is from outside the world of business. It is based on the study for a few years in order to gain a rich source of data for the development a new theory.

Following the above descriptions of time horizon, the cross-sectional studies is more relevant to be adopted based on the research's time and resource constraint.

5.6 Research Techniques

Research techniques and procedures in this context refer to the method for data collection and analysis. The following section will discuss the techniques in detail;

5.6.1 Data Collection

As stated in research choices, this research follows qualitative multi data collection techniques as a main source for the primary and secondary data. Based on its strengths and weaknesses (refer Table 1), interview (group interview or more commonly termed as a workshop) is identified as the main method to be applied for the primary data collection process while literature review has been used as a main source for the secondary data in this research.

5.6.1.1 Literature Review

Literature reviews in this study are to gather information related to the integrated team approach. The process involved a comprehensive literature review of secondary source of data including reports, tools and guidelines that particularly related to team integration such as integrated project delivery, design and build procurement, partnering, supply chain management, concurrent engineering, lean principle etc. All the documentations have been reviewed rigorously in order to identify the critical success factors (CSFs) for developing a framework for an effective integrated design

team delivery in Malaysian IBS projects. The findings of the literatures are shown in the Table 2 below.

Table 2; Critical Success Factors of effective Integrated Design Team (Literature source)

Factor	Component	Source
Personal Working Attitude	• Commitment, motivation and continuity	Liddell, 2010; Koutsikouri, 2008; Seligman, 2002; Johansson, 2002
	• Openness to learn with positive self improvement	Koutsikouri, 2008; Holland et al., 2000; Jassawalla and Sashittal, 1998; Amabile, 1997
Team Base Accountability	• Has 'sense of ownership' attitude	IPD, 2007; Abdelhamid, 2007; Bowron, 2002; Holland et al., 2000; Jassawalla and Sashittal, 1998
	• Clear roles and responsible	Love and Gunasekaran, 1998; Rowlinson, 1999; Anumba & Evbuomwan, 1997; Ayers et al., 1997
Team Base Organisation	• Flat and direct organization structure	Garza et al., 2009; Koutsikouri, 2008; Baiden et al., 2006; Pan et al., 2005; Love et al., 2004; Holland et al., 2000; Evbuomwan and Anumba, 1998;
	• Early and flexible involvement of multidisciplinary key participants	Garza et al., 2009; BuildOffsite, 2008; Koutsikouri, 2008; Pan et al., 2005; Love et al., 2004; Holland et al., 2000; Evbuomwan and Anumba, 1998; Love and Gunasekaran, 1998
	• Appropriate skill with transparent selection process	Koutsikouri, 2008; Baiden et al., 2006; Holland et al., 2000; Evbuomwan and Anumba, 1998
Management of Leadership	• Senior and top management support	Jassawalla and Sashittal, 1998; Denison et al., 1996; Holland et al., 2000
	• Team empowerment	Jassawalla and Sashittal, 1998; Denison et al., 1996;
	• Mutual team based benefits, risks, rewards and recognition	Jassawalla and Sashittal, 1998; Denison et al., 1996; Khang and Moe, 2008; Holland et al., 2000
	• Education and training	Jassawalla and Sashittal, 1998; Denison et al., 1996; Khang and Moe, 2008; Turner and Muller, 2007; Appelbaum, 2007; Parker, 2003; Holland et al., 2000
Transparent Communication	• Symbiotic Relationship	Koutsikouri, 2008; Holland et al., 2000
	• Informal communication and relationship	Koutsikouri, 2008; IPD, 2007; Anumba et al., 2002; Bowron, 2002; Baiden et al., 2006; Holland et al., 2000; Pinto and Slevin, 1987
	• Mutual respect, trust and understanding	Koutsikouri, 2008; IPD, 2007; Anumba et al., 2002; Hoegl and Gemuenden 2001; Holland et al., 2000; Pinto and Slevin, 1987; Smith, 2006; Baiden et al., 2006; Strategic forum for construction, 2003; Edmondson, 1999
Policy	• Clear vision and goal	Nifa and Ahmed, 2010; UKCG, 2009; Baiden, 2006; Egan, 2002; Holland et al., 2000

	• Client and customer focus orientation	Baiden, 2006; Egan, 2002; Holland et al., 2000 UKCG, 2009; Egan, 2002; Baiden et al., 2004; Ngowi 2000; Peace, 2008; Eriksson et al., 2007; Morledge et al., 2006; Alsagoff & Mc Dermott, 1994; Jones, 2000; Rahman & Kumaraswamy, 2002
Procurement and contract	• Two stages of tendering process	Peace, 2008; Eriksson et al., 2007; Morledge et al., 2006
	• Single contractual and procedures approach	UKCG, 2009; Baiden, 2006; Egan, 2002
Operational	• Intensify planning with co-located of teams	Stapley, 2006; Love et al., 2004; Strategic forum for construction, 2003; Bromley et al., 2003; Anumba et al., 2002
	• Interaction space and utility	Baiden et al., 2006; Love et al., 2004
	• Non-operational boundary	Baiden et al., 2006; Anumba et al., 2002; Holland, 2000
	• Integrated and concurrent working	Stapley, 2006; Baiden et al., 2006; Love et al., 2004; Anumba et al., 2002; Austin et al., 2002; Holland, 2000; Pinto et al., 1993; Moore and Dainty, 1999; Dennellon, 1993
	• Collaborative, independent and supportive environment	Baiden et al., 2006; Love et al., 2004; Bromley et al., 2003; Anumba et al., 2002; Austin et al., 2002; Holland, 2000; Pinto et al., 1993; Dennellon, 1993
Appropriate Technology	• Integrative knowledge sharing	Koutsikouri, 2008; Mohammed et al., 2004; Stough et al., 2000; Holland et al., 2000; IDP, 2007; Anumba et al., 2002; Durst and Kabel, 2001; Anumba et al, 1997
	• Project management tool/technique	Koutsikouri, 2008; Mohammed et al., 2004; Stough et al., 2000; Holland et al., 2000; IDP, 2007; Anumba et al., 2002; Durst and Kabel, 2001; Kamar et al., 2010; Anumba et al, 1997; CIDB, 2003
	• Integrative networking system	Holland et al., 2000; Durst and Kabel, 200; Stough et al., 2000

Unfortunately, the findings of the previous studies and tangible examples of 'full' integration, especially in the Malaysian construction industry, are limited. It is worsened by the literature review which explored team integration frameworks, tools or strategies as they identified varying advantages and disadvantages between them, which have led to confusion for Malaysian IBS practitioners as to how to select the best or most appropriate approach towards improved integrated team practice.

In addition, Bell (1999) warned that secondary data has the disadvantage of becoming out-of-date, as well as not being appropriate for the precise needs of a

particular research problem. More importantly, Mohammad (2011) claimed that secondary data by itself cannot meet the specific needs of particular situations, problems or settings, and it is essential to obtain primary data to overcome this shortcoming. Therefore, this research needs to generate a field study to gather some primary of qualitative data that is related to the Malaysian IBS construction industry.

5.6.1.2 Interview (Focus Group Interview/Workshop)

As explained in the previous section, the secondary data of the literature review requires a combination of primary data in order to ensure that it is more comprehensive, up-to-date and appropriate for the precise needs of this study. As highlighted by Mohammed (2011), this method of data collection is able to assist in the revision and refinement of the literature review identified from the various sources such as the internet websites, academic books, research journals and other documented reports. Accordingly, a qualitative research (verbal survey) is conducted to gather a qualitative primary of data to be combined with secondary data of literature for the developing process of an effective integrated design team delivery.

As the aim of this research is to obtain data based on multidisciplinary IBS stakeholders' perspectives, therefore focus group interviewing (otherwise referred to as workshop in this research) is particularly suited as the principal technique for data collection. Another reason for the selection of this technique is to draw upon respondents' experiences and reactions in a way in which would not be feasible using other methods, for example observation, one-to-one interviewing, or questionnaire surveys. These reactions (i.e. attitudes, feelings and beliefs) may be partially

independent of a group or its social setting, but are more likely to be revealed via the social gathering and the interaction which being in a focus group entails. Compared to individual interviews, which aim to obtain individual reactions (i.e. attitudes, beliefs and feelings), focus groups elicit a multiplicity of views and emotional processes within a group context (Gibbs, 1997).

During the data collection stage, the workshop involves organised discussion with a selected group of individuals from different backgrounds (i.e. designers, contractors, manufacturers etc.) to gain a deep information about their views and reaction of a topic. Two workshops will be conducted in order to accomplish the research need. The first workshop was conducted purposely for data gathering (it was attended by 15 participants from different backgrounds of IBS stakeholders including clients, manufacturers, designers, and contractors) whilst the second workshop (attended by 52 participants, some of whom attended the first workshop) was organised with intent for the validation of the framework. Detail explanation of the first workshop is presented in the following section, however the information captured from the evaluation and validation process (workshop 2) will be presented in the final thesis due to the limitation in Internal Evaluation report requirement (not to exceed 15, 000 words).

5.6.2 Data Analysis

Previous researchers (Easterby-Smith et al., 2002; and Burns, 2000) indicated that the purpose of analyzing the data is to find meaning in the data, and this is done by systematically arranging and presenting the information this process requires both a

clear explanation of how the analysis was done, and a demonstration of how the raw data was transformed into a meaningful conclusion.

One of the commonest approaches to analysing qualitative data is called 'Template Analysis' originated by King (2004). Template analysis refers to 'codebook analysis' or 'thematic coding' and is a form of textual analysis that focuses on using the textual content to describe a phenomenon (King, 2006). Saunders et al., (2009) further described that the essence of the approach is that the researcher produces a list of codes or categories ('template') that represent the themes or issues revealed from the data that have been collected. This code is very important for researcher for the interpretation process. As discussed by the King (2004), some of these (code) will usually be defined as a priori, but they will be modified and added to as the researcher reads and interprets the texts.

The workshops however do not focus on identifying relationships between themes, but rather, identifying CSFs and gathering a detailed explanation in order to gain a deep understanding of the problem. This clearly justifies why template analysis is to be used in this research in order to gain perspectives (experiences and practices) from multidisciplinary backgrounds of IBS stakeholders in Malaysian construction projects. Furthermore, due to the numbers of interviews (one group interview), the data set was relatively small in quantity, and therefore the researcher decided there was no inherent need for NVivo or other such computer aided analysis software. Thus, all the data from this research will be managed manually by using manual coding technique in respect of the transcripts from the individual interviews. This

involves the manual identification of the CSFs that will emerge within the interview transcripts.

In transcribing all the information gathered from workshop, this research will follow King's template analysis guideline. King (2006) developed three analytical stages (refer Figure 5) in analyzing interview transcripts for research; creating the initial template; revising the template; finalizing the template.

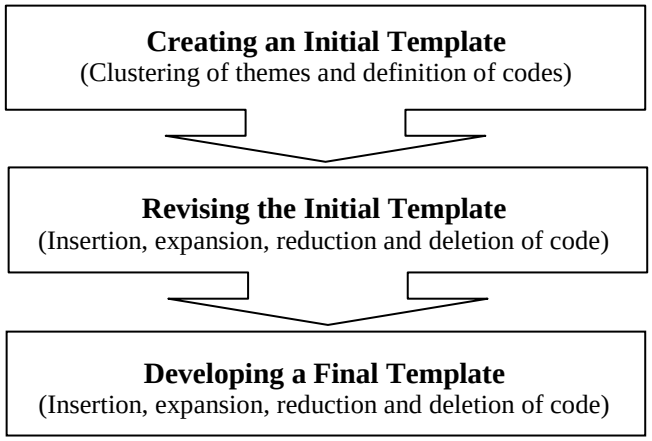

Figure 5: The steps of Template Analysis (King, 2006)

The starting point for creating the initial template is the workshop agenda, which includes a set of question areas, probes and prompts used by the researcher (King, 2006). The topic guide is drawn from the multi sources that particularly relate to the study such as academic literature, the researcher's own personal experience, anecdotal and informal evidence, and exploratory research. Once the initial template is constructed, it must be revised by the researcher in order to reveal any inadequacies that arise within the template. Modifications to a template usually take one or more of the following forms; insertion, deletion, expansion or changing scope, and changing high-order classification (King, 2006; King 1998). The most difficult

decision during the developing template's process is the final stage or namely as 'developing final template.' It is because the researcher has a constraint in term of time limited to produce an 'ideal' template (King, 2006). Commonly, the template could be considered final when most or all of the data (transcripts) have been read through at least three or four times then it will be confident to stop the development of template.

Detail processes of the creating initial template, revising the initial template and creating the final template analysis for this research are explained as below;

- ***Preliminary coding:*** Defining 'themes' and 'codes' are two main processes in the development of initial template analysis. According to King (2011), *'themes'* are features of participant's perceptions or experiences relevant to the research question while *'coding'* refers to the process of identifying themes in accounts and attaching with label (codes) to index them. In this research, the data analysis process is begun by translation process of all the interviews transcripts (fully of conducted in Malay) from Malay to English. The transcripts were read manually and data has been coded by hand (using colour coding) to help ease the cumbersome process of conventional coding. This kind of collaborative strategy could increase the efficiency of the analysis since the development of the template occurs simultaneously to the coding process (King, 1998). However, according to King (2004), there is a danger during this process of neglecting some aspects of the data. Therefore, all the transcripts were re-read several times to ensure that all the themes related to this investigation were highlighted and that nothing was omitted.

Besides that, the researcher also reconfirmed the meaning stated in transcripts by phone call with some of the respondents to avoid misunderstanding or misinterpreting the points of discussions.

- ***Clustering of themes and definition of codes*:** Template analysis normally starts with some predefined codes or using a priori themes as a guide for the analysis process. King (2004) however suggested that the use of priori themes should be restricted as far as possible. This is because a highly number of priori themes might be blinkered effects and prevents the exploration of more pertinent issues during the analysis process (King, 2011). On the other hand, too many codes may lead to an overwhelming mass of rich and complex data (Mohammed, 2011). Taking this into account, the researcher defined key themes based on the interview questions and the initial review of the interview's transcripts.

  On the other hand, some of the themes have been identified earlier based on the critical review of literature that focus on critical success factors (CSFs) for the successful of integrated design team delivery. These processes are common in template analysis to identify some themes in advance which is usually referred 'a priori' themes (King, 2011). It creates an advantage in term of to accelerate the initial coding phase of analysis, which is normally very time-consuming (King, 2011). As a result, the initial template was developed as shows in Figure 6 below.

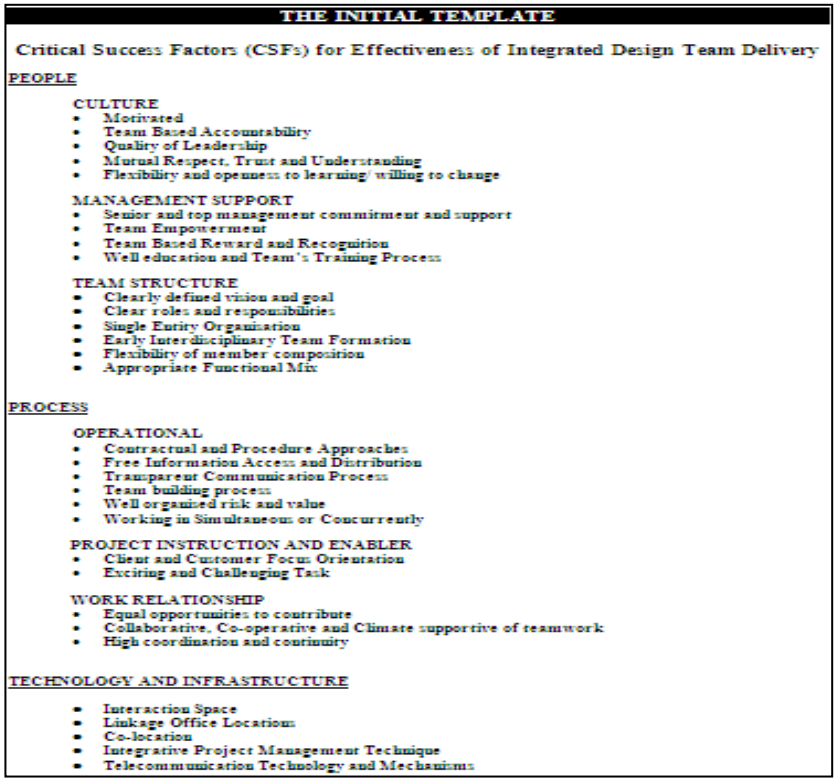

Figure 6: The initial template derived from the evidence from the preliminary coding of the interview transcripts

- **Revising the initial template:** According to King (1998), once the initial template is completed, the template needs to be developed until the researcher feels that it gives as good as a representation as possible of the themes identified in the data. This iterative process involved insertion, deletion, changing the scope and changing the higher-order classification of a theme.

- **Creating the final template:** King (2006) noted that there is no stage where the researcher can say with absolute certainty that the template is 'finished.' It is because there are always others ways of interpreting any set of qualitative data (King, 2011). Mohammed (2011) advocated that, one of the most difficult decisions that faced by the researcher is when to stop the analysis. Although it very difficult to finalize the completed of template however it

easier to make a decision when the research was conducted by group. In the common practice, the researcher makes a pragmatic decision about when to stop the development process otherwise the writing up process cannot be started. On the other hand, the template could be considered final when most or all of the data (transcripts) has been read thoroughly. According to King (2006), the researcher needs re-read at least three or four times for material that was not successfully encompassed by the initial template and changing the template where necessary and know when to stop the development of the template. The final template is presented in Figure 7.


THE FINAL TEMPLATE

Critical Success Factors (CSFs) for Effectiveness of Integrated Design Team Delivery

PEOPLE

- PERSONAL TEAM ATTITUDE
  - 'High commitment, motivation and continuity
  - Openness to learn with positive self-improvement
- TEAM BASE ACCOUNTABILITY
  - Has 'sense of ownership' attitude
  - Team's members are clear roles and responsible for the project
- TEAM ORGANISATION
  - Using matrix organization structure
  - Early form and involvement of multidisciplinary key participants with a flexible composition
  - Right Functional and human mix
- MANAGEMENT OF LEADERSHIP
  - Senior and top management support
  - Team empowerment
  - Mutual team based 'benefits, risks, rewards & recognition
  - Well education and training

PROCESS

- TRANSPARENT COMMUNICATION
  - Has no blame culture
  - Informal Communication and relationship
  - Mutual Respect, Trust and Understanding
- POLICY
  - Clearly vision and mission
  - Clearly direction with a single goal
- PROCUREMENT & CONTRACT
  - Pre approved contract
  - Single contractual and procedures approach
- OPERATIONAL
  - Team co-located with linkages of office location
  - Intensified Planning and Strategy
  - Has interaction space and utility
  - Non-operational boundary
  - Working in Integrative and Concurrently
  - Collaborative, Independence and Supportive Climate

TECHNOLOGY

- APPROPRIATE TOOL/ TECHNIQUE/ SYSTEM
  - Integrative mechanisms to co-ordinate activity and share knowledge
  - Using Project management tool
  - Integrative networking system

Figure 7: Final template of CSFs for effectiveness of Integrated Design Team

Throughout this section, it has demonstrated that template analysis resides in the fact that it is a highly flexible approach that can be modified for the needs of any study in a particular area. It also produces the template and forces the researcher to take a well- structured approach to handling the data, which can be a great help in producing a clear, organized, final account of study (King, 2006).

Regarding the disadvantages, the lack of a substantial literature on this kind of technique as compared to other theories (i.e. grounded theory or discourse analysis) can result in templates that are too simple to allow any depth of interpretation or too complex to be manageable (King, 2006). Furthermore, previous researchers (Mohammed, 2011; and King et al., 2003) widely acknowledged that it was time consuming, and could disregard context from the original text. Therefore, in an attempt to counterbalance these issues, the researcher reread the interview transcripts at least three or four times in order to ensure nothing was missed or neglected.

6.0 Findings and Discussion

The development of the CSF framework is based on the discussion and triangulation of the findings from the literature review as well as the results of the workshop (focus group interview). The literature review identified a list of critical success factors (refer Table 2) for effective integrated design team deliver. Subsequently, the factors detected were then investigated empirically by conducting workshop with Malaysian IBS practitioners. Most of the critical success factors identified in the workshop were similar to the factors that were identified from the literature reviews. There are a few factors especially related to procurement and contract: such as pre approved contract, customized or modified of procurement, 'one stop centre' strategy, and in terms of extension period of design process that are among the new factors considered as critical for the effectiveness of integrated design team delivery in IBS project. These factors were not identified in any previous literatures. Table 3 below illustrated a few examples of findings (texts) from the workshop 1.

Table 3; Critical Success Factors for an effective Integrated Design Team Delivery (workshop findings)

Factor	Component	Finding
Personal Working Attitude	• Commitment, motivation and continuity	*'My style to train and approach our staff members is simple. Firstly, know their expertise, then give the appropriate job, and allocate flexible time for completing the task. This flexibility of strategy will mostly influence them a lot in terms of spiritual and physical work environment' – Participant P14* *'There are three main age categories of people in construction; 20 to 30, 30 to 40, and 40 to 50. Normally, people who are on average between 30 to 40 years old find it easy to adopt an innovation of new knowledge or technology in the construction project. Therefore, this group of people is very significant in gearing a strategy toward a successful integrated team' - Participant P2*
	• Openness to learn with positive self-improvement	*'Personally I think 'openness of thinking' is the key for the team to be excellent and work in a collaborative manner' - Participant P4* *'A few of our engineers are fresh but they are very committed and willing to learn new knowledge, especially one that is related to technology or design software. As senior staff, we are also happy to teach and share our knowledge and skill together' – Participant P10*
Team Base Accountability	• Clear roles and responsible with an agreement	*'During the initial stage, we would call all project members such as consultants, contractors and sub-contractors in order to confirm their scope of work, and at the same time explain the type of project delivery approach that we want to apply in the project' – Participant P9* *'It is essential to let everybody know about the project to clearly understand their respective roles and responsibilities, and then provide the necessary support that is required for better performance in the project delivery process. There is no point telling people what they have to do and then leave them on their own without any follow-up concern' – Participant P4*
Team Base Organisation	• Flat and direct organisation structure	*'The current team structure makes it easier for us to manage the various consultants and other parties who are involved in the design of the project, effectively. It is also easier to ensure that all issues related to design, such as manufacturability and constructability, are dealt with earlier in the beginning of the project' – Participant P14* *'Our project organisation structure is flat which is easier for the team members in contact and communicate directly with senior management' – Participant P2*

	• Early and flexibility of involvement	*'Flexibility and balance of processes between factory and site is critical. For example, when works at the site are stopped, casting at the factory should also cease. Therefore, the concept of early involvement and fully utilisation of collective skills and expertise from both sides during the design stage is very important, especially to prevent double handling and problems with storage. Currently, our team structure has been designed toward that practice' – Participant P4* *'Based on the work experienced while under client, contractor, consultant, and manufacturer, I realised that early involvement of construction expertise during the design stage is vital to reduce design defect and rework during the construction process' – Participant P3*
	• Appropriate skill with transparent selection process	*'One of the main criteria of team member selection is a hundred percent commitment toward the project. A consultant who is managing three or four projects at the same time is not our priority' – Participant P1* *'Other main criteria are well experienced (at least having completed three projects previously), qualified, recognised, and registered with a professional body at least with the Board of Engineers Malaysia' – Participant P14*
Management of Leadership	• Senior and top management support	*'Treasury Circular 7/2008 is a good example of Government instruction in order to boost IBS implementation in the Malaysian construction industry. This endorsement has shown how serious the government is about applying IBS, especially in public projects' - Participant P10*
	• Education and training	*'In our design department, we have eight engineers who are led by me as the design manager. For IBS projects, we use our own system that is originally from the Singaporean standard. Every year, each member will attend some training of the design system conducted by our design checker' – Participant P7*
Transparent Communication	• Informal communication and relationship	*'I mostly agree that a symbiotic relationship between various team members is a vital factor to achieve an effective integrated design team' - Participant P1* *'Normally, we will use weekly meetings to solve our problems. Meetings are an appropriate medium for everybody to declare their problems and it is very effective for avoiding confrontation or miscommunication among members at the site. However, all the members must be well prepared before attending the meeting, otherwise the meeting will end unsatisfactorily' – Participant P4*
	• Mutual respect, trust and understanding	*'We have been working on this project for a long time and I do believe the relationships that exist among us are all good. Every member respects each other and there is no blame culture in our team' – Participant P7*
Policy	• Clear vision and goal	*'The issue of responsibility or liability can be resolved when the consultants are 'ahead in vision' in which manufacturers produce short drawing, based on the layout from a consultant, and endorsement and submission from the consultant' - Participant P8*

	• Client and customer focus orientation	*'The mentality of contractor or consultant toward new technology is dependent on client need. There has no thinking to expand their knowledge, instead of just fulfilling the client need' - Participant P2*
Procurement and contract	• Pre approved contract	*'The aims of the implementation of pre-approved contract is as an initiative to produce an error-free design which can indirectly avoid redesign of drawing during the design phase of IBS project' - Participant P10*
	• Two stages of tendering process	*'A two-stage tendering system is required instead of the one-stage tendering process that is currently being practised in IBS projects. This approach is part of the integrated process for the selection of appropriate and effective design team. It creates a lot of benefits based on our previous projects' – Participant P2*
	• Customization or modification of procurement	*'The current design and build procurement is not a hundred percent appropriate for our project. Some amendments must be done with this procurement in order to suit with the project environment, including insufficient elements that related to team integration such as empowerment of main contractor, early involvement of manufacturer team, and concurrency of work process' – Participant P6* *'A special contract such as IPD or other collaborative contracts, for example as stated in the database of American Institute of Architects (AIA), are required to be implemented in the Malaysian construction industry. The contract can be referred to as a guideline for the project delivery team to implement the early involvement concept effectively' - Participant P1*
	• Extension period in design process	*'The time period of design stage should be longer than three months as is being practised in the current projects. This extension of time will allow the design team to generate a comprehensive discussion session in order to produce drawings with free error of design' - Participant P5*
Operational	• Intensify planning with co-located of teams	*'Failure to plan properly means the works will be delayed and even stopped thus will affect our factory production as well. Therefore, everybody must sit together in advance in order to plan and finalize the drawing early. All the information must be shared and bring forward to produce free error of design in the project' – P5* *'We always think about transportation issues during the design phase to avoid problems such as delay that usually happens during the transportation or delivery process. All the information is discussed with the design team either during consultant meetings or by directly walking into the consultant office' – Participant P4*

	• Integrated and concurrent working	*'Firstly, we would convince conventional consultants and contractors to follow our approach toward integrated practice, namely as 'IPD + BIM'. If they are not able to accept this approach, so we have no choice except to replace them with other parties that are willing to change from the traditional approach to an integrated delivery approach, and work together with us as a single team' – Participant P2* *'Current practice is that the Mechanical and Electrical (M&E) drawings do not come together with structural (C&S) drawings. This creates the issue of lack of coordination between architecture, structure, and M&E during the design process of a construction project' – Participant P1*
	Collaborative, independent and supportive environment	*'In this project, we collaborate with the design-and-build contractor to convince the client to use an integrated delivery approach in order to improve project productivity. The divergence in this project is that we use the combination of integrated practice, namely as 'IPD plus BIM', instead of using the traditional design-and-build in our previous practices' – Participant P1*
	• One Stop Centre	*'There is a desperate need for a 'one-stop-centre' as a place where design, manufacturing, and construction are conducted under one roof. In other words, the role of this centre is to lead and integrate all the stakeholders, such as manufacturers, consultants, and contractors of the IBS project. However, it needs support from the client or Government to realise this, otherwise the implementation would be illegal' - Participant P2*
Appropriate Technology	• Integrative knowledge sharing	*'The priority in our project practice is to collate all project information first from the consultant, contractor, and manufacturer in order to produce the 3D model using BIM software. From this model, we then produce the design for structural, and mechanical and electrical drawings together'– Participant P2*
	• Project management tool/technique	*'Currently, we conduct a value management workshop during the design stage as a medium for discussion among the project team members in order to produce an error-free design in our projects. We believe that this approach is an effective method for improving integration during the design process' – Participant P6*
	• Integrative networking system	*'All the team members can submit the information of the project either by softcopy or hardcopy. The model integrator will gather all this information, standardize into BIM format then upload to the main server to be accessed by the project members' – Participant P1* *'AutoCAD, Esteem, Staad Pro 2005, Orion, Revit, and Tecla are among the software that we always use within the process in order to gather and synchronise all information for developing the 3D model for the IBS project' – Participant P2 & P7*

According to the literature review and workshop, 9 critical success factors and 30 sub-factors (components) were identified as critical for an integrated IBS project. The framework that supports the design team's strategy to improve integration in IBS project can be grouped into three key elements: people, process and technology.

The 'people' element in the framework refers to the personal and human factors such as work attitude, accountability, organisation and leadership. It implies that an IBS design team needs to firstly develop its people capability in order to achieve an effective integrated team. The detail descriptions of each factor are given in Table 4 below.

Table 4; Descriptions of 'people' factor for an effective integrated design team delivery

Factor	Descriptions	Sources
Personal working attitude	**Definition;** "A hypothetical construct that represents an individual's degree of like or dislike for work". **Sub factors (components);** • Commitment, motivation and continuity • Openness to learn with positive self-improvement	Koutsikouri, 2008; Holland et al., 2000; Jassawalla and Sashittal, 1998
Team accountability	**Definition;** "All team stakeholders are responsible for the progress and performance of the project". **Sub factors (components);** • 'Sense of ownership' attitude • Clear roles and responsible with an agreement	IPD, 2007; Abdelhamid, 2007; Holland, 2000
Team Base Organisation	**Definition;** "A group of people working in collaboratively under a systematically structured and managed to pursue or carry out all defined tasks and goals". This type of organisation is important because the construction industry practice consist from a number of different department and functional units with unique identities that come together since at the beginning of the project (construction period) to assume a new identity. Therefore, to be an integrative organization structure, the project team must be fulfilled with components of effective integrated teams. **Sub factors (components);** • Flat and direct organisation structure • Early and flexibility of involvement • Appropriate skill with transparent selection process	Garza et al., 2009; Kumaraswamy and Anvuur (2010); Baiden, 2006; Kahn, 1996
Management of leadership	**Definition;** "Characteristics and capabilities of the team leader's skill and vision to manage and deliver team working culture in the project organization are communicated effectively to all members".	Khang and Moe, 2008; Appelbaum, 2007; Turner and Muller, 2007;

	Sub factors (components); • Senior and top management support (i.e. in terms of scheme and commitment) • Team empowerment (i.e. giving 'autonomy,' 'authority' or 'power' in terms of decision-making authority or responsibility) • Understand and maintain mutual team based benefits, risks, rewards & recognition; • Provide well education and training	Baiden, 2006; Parker, 2003; Holland et al., 2000; Jassawalla and Sashittal, 1998; Belassi and Tuker, 1996; Denison et al., 1996.

Second, in terms of 'process,' the existing design process which is based on the traditional approach needs to be changed and geared more towards a collaborative and integrative design process. The transformation process should include improvement in transparent communication; policy; procurement and contracts; and operational. Detail explanations of the factors are described as below;

Table 5; Descriptions of 'process' factor for an effective integrated design team delivery

Factor	Descriptions	Sources
Transparent Communication	**Definitions;** "Commitment of open, frequent and genuine communication at all levels in the integrated design team organization". This communication process provides tangible opportunities and a channel for all members of the team to directly involve, and to directly input into, the project goals, changes in policies and procedures, status reports, etc. **Sub factors (component):** • Symbiotic Relationship • Informal communication and relationship • Mutual respect, trust and understanding	Koutsikouri, 2008; IPD, 2007; Smith, 2006; Anumba et al., 2002; and Bowron, 2002; Hoegl and Gemuenden 2001; Holland et al., 2000; Pinto and Slevin, 1987
Policy	**Definition;** "A plan or course of action as a design team intended to influence and determine decisions, action and others matters towards successfully integrated practice". **Sub factors (components);** • Clearly vision and mission, • Clearly direction with a single goal (i.e. to meet client customer focus orientation	Nifa and Ahmed, 2010; UKCG, 2009; Baiden, 2006; Egan, 2002; Holland et al., 2000
Procurement and contracts	**Definition;** "A process of obtaining or delivering the project task (such as design) that must be underpinned by contractual forms which encourage the parties (team members) to collaborate rather than in competition". **Sub factors (components);** • Pre approved contract • Two stages of tendering process • Single contractual and procedures approach • Single contractual and procedures approach • Customization or modification of procurement	Nawi & Lee, 2010; UKCG, 2009; Peace, 2008; Eriksson et al., 2007; Morledge et al., 2006; Rahman & Baiden et al., 2004; Kumaraswamy, 2002; Egan, 2002; Jones, 2000; Ngowi 2000

	• Extension period in design process	
Operational	**Definition;** "A process or series of actions towards collaborative work environment for achieving a successful integrated team". This factor includes steps, facility, environmental and space that required towards integrated approach. **Sub factors (components);** • Intensify planning with co-located of teams • Interaction space and utility • Working integrative and concurrently • Collaborative, independence and supportive climate • One stop centre'	Stapley, 2006; Baiden et al., 2006; Love et al., 2004; Strategic forum for construction, 2003; Bromley et al., 2003; Anumba et al., 2002; Austin et al., 2002; Holland, 2000; Pinto et al., 1993

Finally, integrated team practice has to be supported by technology. Technology has been distinguished as an appropriate medium or tool for improving team integration to support and synchronise all the project's information and activities as a whole.

Table 6; Descriptions of 'technology' factor for an effective integrated design team delivery

Factor	Descriptions	Sources
Appropriate Technology	**Definitions:** "Appropriate mechanism or medium to co-ordinate activity; enhance interaction and knowledge sharing within a project team". This factor including communication facility, tool or system need in order to coordinate the detailed design and construction information among team members. **Sub factors (components);** • Integrative mechanisms to co-ordinate activity and share knowledge • Project management tool/ technique • Integrative networking system	Koutsikouri, 2008; Mohammed et al., 2004; Stough et al., 2000; Holland et al., 2000

Detail explanation of the sub-factors (component) will only be highlighted in this report due to report's requirement (must not exceed 15, 000 words). However, the list of the critical success factors identified from the literatures and workshop are depicted in Table 7 below.

Table 7; CSF for effective of integrated design team delivery (IDTD)

	Factor	Component	Literature	Workshop 1
PE	Per son al Wo	• Commitment, motivation and continuity	√	√

		• Openness to learn with positive self-improvement	√	√
	Team Base Accountability	• 'Sense of ownership' attitude	√	x
		• Clear roles and responsible with an agreement	√	√
	Team Base Organisation	• Flat and direct organisation structure	√	√
		• Early and flexibility of involvement	√	√
		• Appropriate skill with transparent selection process	√	√
	Management of Leadership	• Senior and top management support	√	√
		• Team empowerment	√	x
		• Mutual team based benefits, risks, rewards and recognition	√	x
		• Well education and training	√	√
PROCESS	Transparent Communication	• Symbiotic Relationship	√	x
		• Informal communication and relationship	√	√
		• Mutual respect, trust and understanding	√	√
	Policy	• Mutual team vision and mission	√	√
		• Clearly direction with a single goal	√	√
	Procurement and contract	• Pre approved contract	x	√
		• Two stages of tendering process	√	√
		• Single contractual and procedures approach	√	x
		• Customization or modification of procurement	x	√
		• Extension period in design process	x	√
PROCESS	Operational	• Intensify Planning with co-located of teams	√	√
		• Interaction space and utility	√	x
		• Non-operational boundary	√	x
		• Working integrative and concurrently	√	√
		• Collaborative, independence and supportive climate	√	√

		• 'One stop centre'	x	√
TECHNOLOGY	Appropriate Technology	• Integrative mechanisms to co-ordinate activity and share knowledge	√	√
		• Project management tool/ technique	√	√
		• Integrative networking system	√	√

7.0 Developing of Effective Integrated Design Team Delivery Framework

7.1 CSFs Framework for effective Integrated Design Team Delivery in Malaysian IBS Projects

All the critical factors that were identified from the both the literature reviews and workshop are combined in order to develop a framework of the CSFs for effective integrated design team delivery (IDTD) in Malaysian IBS projects (refer Figure 8). This framework will be further validated with an industry workshop. Therefore, it should be noted that all the identified factors will be subject to inclusion or exclusion at the framework validation stage of this study.

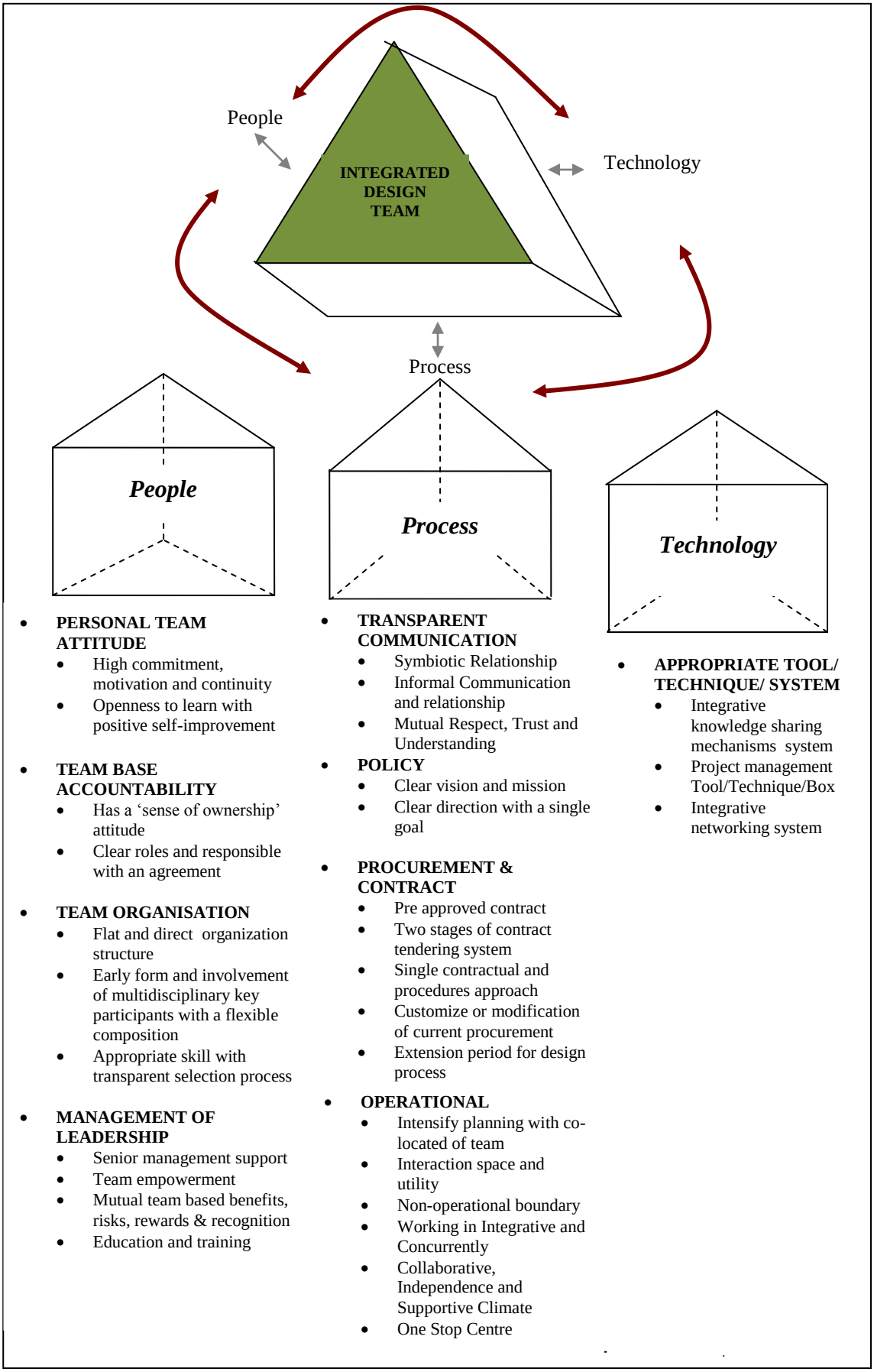

Figure 8: Framework of CSFs for effective integrated design team delivery in Malaysian IBS projects

7.2 Framework Implications

The previous section discussed the development of the framework for effective integrated team that based on the triangulation of the key findings from the literature review and from the findings of workshop. The study however requires further evaluation and validation in order to reconfirm and finalise the importance of CSFs to the framework. Validation processes provide further consolidation, and refine the findings on the process requirements in the framework. The eventual outcome and findings after the validation process develop the final framework for to the successful implementation of integrated design team delivery in an IBS real life project. After finalising the framework, hopefully it will be used as a term of reference for both Malaysian IBS practitioners and academics towards achieving integrated design team practice. For example, identifying the critical success factors characterizing effective integrated design team delivery will guide IBS stakeholders (especially the government and private client) in developing a systematic and comprehensive guideline and policy to improve integration in IBS projects.

In addition, highlighting the critical success factors which underpin the framework expectantly will help IBS stakeholders to manage their own projects in an integrated and efficient way without having to learn lessons the hard way. Although the use of the framework would not instantly transform a team into a fully integrated and high performing one, however, IBS stakeholders should acknowledge the characteristics of an effective integrated team.

Therefore, the researcher believes that this framework will provide a significant step towards improving the performance of the design delivery team if it is followed

carefully. It sets to gradually, but systematically, unearth potential integration practices within design teams so that they can be structured toward effective integration. More importantly, IBS stakeholders need to ensure that the framework is properly structured for effective implementation and monitoring as to avoid introducing too many new techniques at once but more to identify familiar practices that can be geared towards effective design team integration.

8.0 Plans for Future Work

This report has been prepared at the stage of methodology (Chapter 4), data collection stage (Chapter 5) and framework development stage (Chapter 6). The next stage is to focus on the evaluation and validation stage (Chapter 7). Then the recommendation for research improvement and finally the writing up process of the thesis.

9.0 Conclusion

Problems associated with fragmentation in the traditional construction process, such as isolation of professionals, lack of co-ordination between design and construction; and as it is carried out in a sequential manner, have impacted on construction performance leading to a lack of integration, wastage, low productivity and efficiency. Team integration is perceived as paramount. Numerous tools have emerged in recent years to improve disintegration such as relational contracting, procurement, partnering, constructability, supply chain management or concurrent engineering, advocates that an integrated design team approach can improve

construction performance. Unfortunately, the various frameworks, tools or strategies identified varying advantages and disadvantages between them, and this has caused confusion for industry practitioners, especially Malaysian IBS stakeholders, who struggle to determine which one is the best or most appropriate approach towards improved integrated team practice. Mostly important, the tangible examples of 'full' integration especially in the Malaysian construction industry are limited.

Therefore, this research aims to garner information related to integration in the Malaysian construction industry, specifically within the design team of IBS projects. This primary of qualitative data requires to be merged with the findings from the literature review (secondary source of data) in order to ensure that it is more comprehensive, up-to-date and appropriate for the precise needs that particularly for the developing process of an integrated design team delivery framework in Malaysian IBS projects. This framework expectantly will guide the Malaysian IBS practitioners in order to develop a new policy or guideline for improving integration during the design stage to achieve an effective integrated design team delivery in IBS projects.

REFERENCES:

Anumba et al., (2002) Organisation Structure to Support Concurrent Engineering to Construction, *Industrial Management and Data Systems*, 102/5, pp. 260-270.

Abdelhamid (2007) Lean Construction Principles. Graduate class offering at Michigan State University. http://www.slideshare.net/tabdelhamid/lean-construction-introduction

Akintoye, A. (2000) Analysis of factors influencing project cost estimating practice. *Construction Management and Economics*, 18 (1), pp 77-89.

Akintoye, A., McIntosh, G., and Fitzgerald, E. (2000) A survey of supply chain collaboration and management in the UK construction industry. *European Journal of Purchasing & Supply Management*, 6, pp 159-168.

Alsagoff, S.A. & McDermott, P. (1994) In Rowlinson, S (ed.), relational Contracting: A Prognosis for the UK Construction Industry? Proceeding of CIB W92, Procurement System, East Meet West, University of Hong Kong, 11-19.

Amabile, T.M. (1997) Motivating creativity in organizations: on doing what you love and loving what you do, California Management Review, Vol. 40, pp. 39-58.

Amaratunga, D. et al. (2002) Quantitative and qualitative research in the built environment: application of "mixed" research approach, *Work Study*, 51(1), pp 17-31.

Anumba, C.J., Baugh, C., Khalfan, M. M.A. (2002) Organisation Structure to Support Concurrent Engineering to Construction, Industrial Management and Data Systems, 102/5, pp. 260-270.

Anumba, C. J., Evbuomwan, N. F. O., (1997) Concurrent Engineering in Design Build Projects- Construction Management and Economics 15, pp. 271-281.

Appelbaum, S. H. and Gonzalo, F. (2007) Effectiveness and Dynamics of Cross-Functional Teams: A Case Study of Northerntranspo Ltd, *Journal of American Academy of Business, Cambridge;* 10, 2; ABI/INFORM Global pg. 36

Austin, S.A., Baldwin, A.N. and Steele, J.L. (2002) Improving building design through integrated planning and control, Engineering, Construction and Architectural Management, Vol. 9 No. 3, pp. 349-58.

Ayers, D., Dahlstrom, R. and Skinner, S.J. (1997) An exploratory investigation of organizational antecedents to new product success. *Journal of Marketing Research*, 34(1), 107–116.

Baker, K. (2004) Review of Housing Supply: Delivering Stability: Securing our Future Housing Needs HMSO, London

Baiden, B. K., Price A. D. F., and Dainty A. R. J. (2006) The extent of team integration within construction projects, *International Journal of Project Management* Volume 24, Issue 1, January 2006, pp 13-23.

Baiden (2006) Framework for the Integration of the Project Delivery Team, unpublished *PhD Thesis*, Loughborough University, UK.

Belassi, W. and Tukel, O. I. (1996) A new framework for determining critical success/failure factors in projects, *International Journal of Project Management* Vol. 14, No. 3, pp. 141-151.

Blismas, N. and Ron Wakefield (2008) Drivers, constraints and the future of offsite manufacture in Australia, *Construction Innovation,* Vol. 9 No. 1, 2009 pp 72-83

Bourn, J. (2001) Modernising Construction (HC87 Session 2000-2001), London: *National Audit Office*, Jan.

Bowron, J (2002) Re-Engineering the Project Procurement Process Through Concurrent Engineering, *PhD Thesis*, Loughborough University, UK.

Bromley, S., Worthington, J., and Robinson, C. (2003) The impact of integrated Teams on the design process, London: Construction Productivity Network. Buildoffsite (2008), *Your guide to specifying Modular Buildings Maximising value and minimising risk,* Buildoffsite & BAA, London.

Buildoffsite (2008) Your guide to specifying Modular Buildings Maximizing value and minimizing risk Buildoffsite & BAA, London

Burns, R. (2000) *Research Introduction to Research Methods.* London: Sage Publications Ltd.

Buzell, Robert D. and Ortmeyer. (1995) Channel Partnership Streamline Distributions. *Sloan Management Review*, 36(85).

Chung, L. P. (2006) Implementation Strategy for Industrialised Building System, *Unpublished Report for Master Science Construction*, UTM, Johor.

CIDB (2009) Industrialised Building System (IBS): Implementation Strategy from R&D Perspective, July, Kuala Lumpur.

Construction Industry Master Plan - CIMP (2005) Construction Industry Development Board (CIDB) Malaysia, Kuala Lumpur

Collis, J. and Hussey, R. (2003) *Business Research: A practical guide for undergraduate and postgraduate students.* 2nd ed. New York: Palgrave Macmillan.

Creswell, John W. (2009) Qualitative Inquiry & Research Design: Choosing Among Five Approaches. 3rd ed. California: Sage.

Dainty, A. R.J., Briscoe, G.H. and Millett, S.J. (2001) Subcontractor perspectives on supply chain alliances. Construction Management and Economics,1 9 (8), pp. 841-848

de la Garza, J. M., Pinero, J. C., and Ozbek, M. E. (2009) A Framework for Monitoring Performance-Based Road Maintenance, *Proceedings of the Associated Schools of Construction 45th Annual International Conference*, pp 433-441, April 1-4, Gainesville, FL.

Denison, D.R., Hart, S.L. and Kahn, J.A. (1996) From chimneys to cross-functional teams: Developing and validating a diagnostic model, *Academy of Management Journal*, 39, 1005–1022.

Denzin, N.K. and Lincoln, Y.S. (2000) Collecting and Interpreting Qualitative Materials, 2nd ed. United States; Sage Publication.

Department of Statistics Malaysia (2011) *Labour Force Survey Report*, First Quarter 2011, series no 26, vol. 2 June 2011.

Donnellon, A. (1993) Cross-functional teams in product development: Accommodating the structure to the process. Journal of Product Innovation Management 10:377–392.

Dulaimi, M.F. Ling, F.Y.Y. Ofori, G. and Silva, N.D. (2002) Enhancing integration and innovation in construction, *Building Research & Information,* http://www.tandf.co.uk/journals.

Durst, R. and Kabel, D. (2001) Cross-Functional teams in a Concurrent engineering, Environment-Principles, Model, and methods, Virtual Teams, Volume 8, pages 167-214.

Easterby-Smit, M., Thorpe, R. and Lowe, A. (2002) Management Research an Introduction, London, SAGE Publications Ltd.

Easterby-Smith M., Thorpe, R. and Jackson, P., (2008) Management Research: Theory and Research, Sage, London, ISBN: 9781847871770.

Edmondson, A. C. (1999) Psychological safety and learning behaviour in work teams, Administrative Science Quarterly, 44,350-383.

Egan, J. (2002) Accelerating Change, *Strategic Forum for Construction*, London.

Egan, J., (1998) Rethinking construction, report of the construction task force on the scope for improving the quality and efficiency of UK construction industry, Department of the Environment, Transport and the Regions, London.

Eriksson, P.E., Dickinson, M., and Khalfan, M.A., (2007) The influence of partnering and procurement on subcontractor involvement and innovation, Facilities Vol. 25 No. 5/6, pp. 203-214.

Evbuomwan, N.F.O., and Anumba, C.J. (1998) An integrated framework for concurrent life-cycle design and construction, *Advances in Engineering Software*, Vol. 29 No.7-9.

Fikri (2005) Note in IBS Course, *Institute of Bumiputra*, Malaysia

Flanagan, R. and Norman, G, (1993) Risk Management and Construction. Oxford: Blackwell Publishing Ltd

Gibb, A.G.F. (1999) Off-site Fabrication: Prefabrication, Pre-assembly and Modularisation, Whittles, Caithness.

Gray, D.E. (2004) *Doing Research in Real World*, Sage Publication, London.

Grix, J. (2010) The Foundations of Research, 2nd Ed. Palgrave Macmillan, London.

Hamid, A.R.A., Singh, B., Yusof, A.M., and Abdullah, N.A.M. (2011) *2nd International Conference on Construction and Project Management (IPEDR),* Vol.15 (2011) © (2011) IACSIT Press, Singapore

Hamid, Z. Kamar, K. A. M. Zain, M. Ghani, K. and Rahim, A. H. A. (2008) Industrialized Building System (IBS) in Malaysia: the current state and R&D initiatives, *Malaysia Construction Research Journal*, Vol. 2 (1), pp 1-13

Haron, N.A. Rahman, H.A. Hanid, M. (2009) A Literature Review of the Advantages and Barriers to the Implementation of Industrialised Building System (IBS) in Construction Industry, *Malaysia Construction Research Journal,* Vol. 4 (1), pp 10-14.

Haron, N. A. Hassim, S. Kadir, M. R.A. & Jaafar, M. S. (2005), Building Costi Comparison Between Conventional and Framework System, *Journal of Technology*, 43(B), UTM, Johor, Malaysia.

Hassim, S. Sazalli, S. A. A. H. Jaafar, M. S. (2008) Identification of Sources of Risk in IBS Project, *European Journal of Social Sciences*, Vol. 6, Number 3.

Hoegl, M. M., Gemuenden, H. G. (2001) Teamwork quality and the success of innovative projects: A theoretical concept and empir- ical evidence. Organisation Sci. 12(4) 435-449.

Holland, S., Gaston, S. and Gomes, J. (2000) Critical success factors for cross-functional teamwork in new product development, International Journal of Management Reviews, Vol. 2 No. 3, pp. 231-259.

Housing Forum (2000) New Homes National Customer Satisfaction Survey 2000 (London, The Housing Forum).

Hyde, K. (2000) Recognizing deductive processes in qualitative research Qualitative Market Research, International Journal, Vol. 3, No. 2, pp. 82-90.

Ibrahim, O. (2003) Challenges in the Development of Steel Construction in Malaysia, *Proceedings of the International Conference on Industrialised Building Systems (IBS 2003) Global Trends in Research*, Development and Construction, Kuala Lumpur, pp 2-8

IBS Roadmap Review (Final Report) (2007) IBS Centre, Construction Industry Development Board, Malaysia, Kuala Lumpur (unpublished).

IBS Roadmap (2003-2010) (2003) Construction Industry Development Board (CIDB), Kuala Lumpur.

IEM (2001) A Need for new building technologies, *Bulletin of Institution of Engineers, Malaysia,* February.

Integrated Project Delivery (IPD): A Guide (2007) California Council, National, The American Institute of Architects, version 1.

Jassawalla, A.R. and Sashittal, H.C (1998). An examination of collaboration in high-technology new product development processes. *Journal of Product Innovation Management*, 15, 237–254.

Johansson, G. (2002) Success Factors for integration of eco-design in product development; A review of state of art, environmental Management and Health, Vol. 13, No. 1, pp. 98-107.

Jones, D. (2000) Project Alliances, Proceeding of Conference on 'Whose Risk' Managing Risk in Construction – Who Pays, Hong Kong, November.

Kagioglou, M., *et al.* (1998) Generic Design and Construction Process Protocol: final report. *In*: The University of Salford.

Kahn, K.B. (1996) Interdepartmental integration: a definition with implications for product development performance. *Journal of Product Innovation Management*, 13, 137–151.

Kamar, K. A .M, Alshawi, M., and Hamid, Z. (2010) The Critical Success Factors (CSFs) to Offsite Construction Companies - a case study analysis, *paper proceedings in CIB World Conference*, Salford.

Kamar, K. A. M. Alshawi, M. and Hamid, Z. A. (2009) Barriers to Industrialised Building System (IBS): The Case of Malaysia, In *BuHu 9th International Postgraduate Research Conference (IPGRC) (Eds*., Alshawi, M., Ahmed, V., Egbu, C. and Sutrisna, M.), Salford, United Kingdom.

Keraminiyage, K.P. (2009) Achieving high process capability maturity in construction organisations, unpublished *PhD Thesis*, University of Salford, UK.

Khang, B. D., and Moe, L.T. (2008) Success Criteria and Factors for International Development Projects: A Life-Cycle-Based Framework, Project Management Journal, vol. 39, no. 1, pp 72-84

King, N. (1998) 'Template analysis', in G.Symon and C.Cassell (eds.) *Qualitative Methods and Analysis in Organizational Research.* London: Sage.

King, N., Thomas, K. and Bell, D. (2003) An out-of-hours protocol for community palliative care: practitioners' perspectives, Internal Journal of Palliative Nursing, 9(7): 277-82.

King, N (2004) Using Templates in the Thematic Analysis of Text, In C. Cassell and G. Symon (Eds.), Essential Guide to Qualitative Methods in Organizational Research. London, U.K.: Sage.

King, N (2006) Professional identities and innovation: a phenomenological constructivist approach. British Academy of Management Conference, Belfast.

King (2011),
http://www2.hud.ac.uk/hhs/research/template_analysis/example1/ftemplate.htm

Koutsikouri, D., Austin, S., and Dainty, A. (2008) Critical success factors in collaborative multi-disciplinary design projects, Journal of Engineering, Design and Technology, Vol. 6 No. 3, pp. 198-226

Kumaraswamy, M.M., & Anvuur, A.M. (2008) Selecting sustainable teams for PPP projects, Building and Environment, Vol. 43, pp. 999-1009.

Latham, M. (1994) Constructing the Team, Final report on joint review of procurement and contractual agreements in the UK construction industry. HMSO, London.

Lee, H.L. and Whang, S. 2000: Information sharing in a supply chain. *International Journal of Manufacturing Technology and Management* 1, 79–93.

Liddell, D. (2010) http://www.evancarmichael.com/Productivity/3311/Motivation-Through-Teamwork.html

Love, P.E.D. Irani, Z. Edwards, D.J. (2004) A seamless supply chain management model for construction, *Supply Chain Management: An International Journal*, Vol. 9 No.1, pp 43-56.

Love P. E. D., Gunasekaran, A. and Li H. (1998) Concurrent Engineering: A Strategy for Procuring Construction Projects. *International Journal of Project Management*, Vol. 16(6), pp 375-383.

Malaysian Construction Outlook 2008 (2008) *Presentation by Business Development Division,* Construction Industry Development Board (CIDB), August 2008.

Mohammad, A. F. (2011) The Development of a Framework to Aid the Identification of Factors Inhibiting Bank Staff's Attitude towards E-Banking Adoption in Libya, unpublished *PhD Thesis*, University of Salford, UK.

Mohamad, I. M. (1999) The Application of Concurrent Engineering Philosophy to the Construction Industry, *Thesis PhD*, Loughborough University.

Morledge, R., Smith, A., Kashiwagi, D.T. (2006), Building Procurement, Blackwell Publishing.

Nawi, M.N.M., Nifa, F.A.A., Abdullah, S. & Yasin, F.M. (2007) A Preliminary Survey of the Application of IBS in Kedah and Perlis Malaysian Construction Industry, *Proceeding in Conference in Sustainable Building*, Malaysia.

Nawi, M.N.M. and Lee, A. (2010) Improving Team Integration in Malaysian IBS Construction Projects, 4th International Conference On Built Environment in Developing Countries (ICBEDC 2010), 1st – 2nd December, Universiti Sains Malaysia, Malaysia.

Ngowi, A. B. (2000) Construction procurement based on concurrent engineering, *Logistics Information Management*, vol. 13(6), pp 361-368.

Nifa, F.A.A., and Ahmed, V. (2010). Effective Partnering in Construction – A Critical Literature Review, 4th International Conference On Built Environment In Developing Countries (ICBEDC 2010), 1st – 2nd December, Universiti Sains Malaysia, Malaysia.

Pan, W. (2006) Cost Effective and Innovative Solutions Using Offsite Techniques, *Construction Productivity Network (CPN) Members' Report E6103, CIRIA*, London.

Pan, W., Gibb, A. G. F. and Dainty, A. R. J., (2005) *Offsite Modern Methods of Construction*, Housebuilding Perspectives and Practices of Leading UK,.

Parker, G. (2003) Leading a team of Strangers, Training & Development, 57(2), 21-23.

Parry, T., Howlett, C. and Samuelsson-Brown, G. (2003) Off Site Fabrication: UK Attitudes and Potential. *Report 17356/1*, *BSRIA*, Bracknell.

Patton, M. Q. (2002) Qualitative Research and Evaluation Methods, 3rd edition Sage, Thousand Oaks.

Phillips, E. M. and D. S. Pugh (2005) How to Get a PhD. London, *Open University Press*, McGraw-Hill.

Pinto, M.B., Pinto, J.K. and Prescott, J.E. (1993) Antecedents and consequences of project team cross-functional cooperation. *Management Science*, 39(10), 1281–1297.

Pinto. J K and Slevin, D P (1987) Critical factors in successful project implementation' *IEEE Trans Eng Management* EM-34 22-27

Rahman, M. & Kumaraswamy, M.M. (2002) Joint Risk Management through transactionally efficient relational contracting,' Construction Management and Economics. 20(1), 45-51.

Robson, C. (2002) Real World Research, 2nd ed. Blackwell Publication.

Robson, C, (2007) How to Do a Research Project; A Guide for Undergraduate Students, Oxford, Blackwell Publishing.

Rowlinson, S., (1999) A definition of Procurement systems- A guide to Best Practice in Construction, Rowlinson, S., McDermott, P., (eds) -E& FN Spon.

Russell, Jeffrey S., (1994) Comparative analysis of Three Constructability Approaches, *ASCE Journal of Construction Engineering & Management*, Vol. 120. No 1 Mar.

Sarantakos, S. (2005) Social Research, 3rd ed. Palgrave MacMillan Ltd.

Saunders, M., Lewis, P, and Thornhill, A. (2003) Research Methods for Business Students, Pearson Eduction Limited.

Saunders, M., Lewis, P. and Thornhill, A. (2009) Research methods for business students. 5th ed. Harlow: Pearson Education Ltd.

Saunders, M., Williams C.S. and Jones, C. (2008) Doing things right or doing the right things? Using the Extended Service Template Process to facilitate learning, Paper presented at 9th *International Conference on Human Resource Development Research and Practice Across Europe*, Lille.

Saunders, M., Lewis, P. and Thornhill, A. (2007) Research methods for business students. 4th ed. Harlow: Pearson Education Ltd.

Seligman, M.E. (2002) Authentic Happiness, Free Press, New York, NY.

Senturer, A. (2001) Which Industrialised Systems Are Appropriate for Turkey, available at: *www.emu.edu.tr/academic/publicat/archpub/arch-32a.htm*

Setiawan, W. and Sutrisna, M. (2010) Investing the Potential of Built environment in Promoting Social Cohesion within an Urban Environment. In EGBU, C. & Lou, E. (eds.) 16th Annual Conference of Association of Researchers in Construction Management (ARCOM). Leeds, Association of researchers in Construction Management (ARCOM).

Sexton, M. (2003) A Supple Approach to Exposing and Challenging Assumptions and Path Dependencies in Research. *In: Keynote speech of the 3rd International Postgraduate Research Conference. April, 2003,* Lisbon.

Shaari, S.N. and Ismail, E. (2003) Promoting the Use of Industrialised Building Systems (IBS) and Modular Coordination (MC) in the Malaysia construction industry, *Bulletin of Institute Engineers Malaysia (IEM)*, pp 14-26.

Smith, I. (2006) Continuing professional development and workplace learning – 14 Communicating in times of change, Library Management Vol. 27, No. 1/2, pp. 108-112.

Song, L. Mohamed,Y. and Abou Rizk, S.M. (2009) Early Contractor Involvement in Design and Its Impact on Construction Schedule Performance, *Journal of Management in Engineering @ ASCE*, Vol. 25, No. 1.

Sonnenwald, D.H. (1996) Communication roles that support collaboration during the design process, *Design Studies,* Vol. 17 No 3 July.

Sparksman, G., Groak, S., Gibb, A. and Neale, R. (1999) Standardisation and Pre-assembly: Adding Value to Construction Projects, *CIRIA*, London.

Stapley, L.F. (2006) Individuals, Groups and Organisations: Beneath the Surface, Karnac Books, London.

Stough, S., Eom, S. and Buckenmyer (2000) Virtual teaming; a strategy for moving your organisation into the new millennium, Industrial management and data systems, Vol. 100, pp. 370-8

Strategic Forum for Construction (2003) The integration toolkit guide: Integrated project team, London: *Strategic Forum for Construction*

Sutrisna, M (2009) Reserch Methodology in Doctoral Research: Understanding the Meaning of Conducting Qualitative Research ARCOM doctoral workshop at Liverpool John Moores University on Tuesday 12 May 2009.

Thanoon, W. A. M., Peng, L. W., Abdul Kadir, M. R., Jaafar, M.S. and Salit, M.S. (2003) The Experiences of Malaysia and Other Countries in Industrialised Building System in Malaysia, *Proceeding on IBS Seminar*, UPM, Malaysia.

Titus, S. and Brochner, J. (2005) Managing information flow in construction supply chains, *Construction Innovation*, 5: 71–82.

Tobi, S. U.M. (2010) Social Enterprise Applications in an Urban Facilities Management Setting: A Service Delivery Model, unpublished *PhD Thesis*, University of Salford, UK.

Turner, J.R. & Muller, R. (2007) Matching the project manager's leadership style to project type. *International Journal of Project Management*. *25*, 21-32.

UKCG Report, (2009) Construction in the UK Economy, The Benefits of Investment, UK Contractors Group, *Construction in the UK economy*.

Venables, T., Barlow, J. and Gann, D. (2004) Manufacturing Excellence: UK Capacity in Offsite Manufacturing, *The Housing Forum*, London.

Vincent, S. and Kirkpatrick, S. W. (1995) Integrating different views of integration, In P. Brandon and M. Betts, eds. *Integrated construction infonnation*, 1st ed, London: E& FN Spon.

Vyse, S. (2001) Fusion :a new approach to working, London: G1axoWelleome

Waleed, A.M.T., Lee Wah Peng, M.R.A. Kadir, Mohd. Saleh Jaafar and Mohd. Sapuan Salit (2003) The essential characteristics of industrialized building system, *International Conference on Industrialised Building Systems*, Kuala Lumpur, Malaysia, pp.283-295

Xiao, H. (2002) A Comparative Study of Contractor Performance based on Japanese, UK and US Construction Practice, unpublished *PhD Thesis*, University of Wolverhampton, UK.

Yin, R. K. (1994) Case Study Research Design and Methods, 2nd ed., Thousand Oaks, CA: Sage Publications, Inc.

Yin, R.K. (2003) Case Study Research: Design and Methods. *3rd ed. London: Sage Publications.*

Yin, R. K. (2009) Case Study Research: Design and Methods, 4th ed, California, London, SAGE.

APPENDIX A:
LIST OF PUBLICATION

PUBLICATIONS

List of Publication (based on research)

1) Nawi, M. N. M., Hanifa, F. A. A., Kamar, K. A. M., Lee, A., and Azman, M. N. A. (2014) Modern Method of Construction: An Experience from UK Construction Industry, *Australian Journal of Basic and Applied Sciences*, 8(5): 527-532.

2) Nawi, M. N. M., Lee, A., and Omar, M. F. (2014) A Review of Supply Chain Management Issues in Malaysian Industrialised Building System (IBS) Construction Industry, *Australian Journal of Basic and Applied Sciences*, 8(5): 533-538.

3) Nawi, M. N. M., Baluch N., and Bahauddin, A. Y. (2014) Impact of Fragmentation Issue in Construction Industry: An Overview, MATEC Web of Conference, 15, EDP Science.

4) Nawi, M.N.M., Baluch N., Omar, F. (2013) Dimension of Fully Integrated Team Delivery for Malaysian Industrialised Building System (IBS) Construction Projects. The 3rd International Building Control Conference 2013 (IBCC2013), Kuala Lumpur, Malaysia, 21st November 2013.